Minnesota Pollution Control Agency

Minnesota River Valley Public Utilities Commission WWTP
NPDES/SDS Permit No. MN0068195

RESPONSE TO COMMENTS ON THE DRAFT PERMIT

Minnesota Pollution Control Agency's response to comments received in a November 11, 2016, letter from the Minnesota River Valley Public Utilities Commission.

Executive Summary

The Minnesota River has high levels of algae on average. Algae are an important part of the food web of rivers, but too much is not good. When algal levels are high, only the toughest fish and aquatic insects can survive. And, the smelly and murky water makes canoeing and swimming on the river unpleasant.

High levels of the nutrient phosphorus are needed to produce large algal blooms. In 2015, the Minnesota Pollution Control Agency (MPCA) adopted rules which included standards (targets) for total phosphorus (TP) and algae in rivers. Now, when TP levels and algal levels are too high, the MPCA is required by law to develop a plan to reduce levels of TP, which will reduce algal levels to desirable levels.

There are many sources of TP to the Minnesota River. The MPCA used a complex computer program (i.e., computer model) to determine how to meet the TP target for the Minnesota River. This model included reductions of TP from non-point sources such as stormwater from cities, runoff from fields, and streambank erosion. The model also included the numerous wastewater treatment facilities (WWTFs) throughout the large drainage area of the Minnesota River Basin, including the Minnesota River Valley Public Utilities Commission (MRVPUC). Limits for the WWTFs based on the model results are one of several management actions in the Minnesota River Basin needed to achieve a cleaner Minnesota River.

The MPCA worked with the U.S. Environmental Protection Agency for over two years on developing its procedures for implementing effluent limits to meet the phosphorus standards for rivers. Recently the Minnesota Court of Appeals affirmed a process for setting limits that was the same as the process used for the MRVPUC WWTFs limits.

Comment 1: Limits set based on the implementation procedures document is a violation of state law.

Summary Response 1: MPCA's implementation procedures are not a violation of state law. No new rules or regulations are created in the *Procedures for Implementing River Eutrophication Standards in NPDES Wastewater Permits document* (implementation procedures document). The implementation procedures document provides examples to help clarify the process MPCA staff use to develop effluent limits based on state law and federal regulations. Here, the proposed TP effluent limits for the MRVPUC WWTF are based on complex computer calculations also known as a computer model. The MPCA has established limits for other WWTFs based on models and this process has been upheld by the Minnesota Court of Appeals.

Comment 2: The MPCA failed to implement the RES based on long-term summary average conditions.

Comment 2a: Limits are not based on a long-term summer average concentration.

Summary Response 2a: The TP limit being questioned is based on the predicted long-term summer average TP of the Minnesota River. The computer model predicts the daily summer concentration of TP for the Minnesota River for 14 years. The total phosphorus limit for MRVPUC is based on the average of the predicted values needed to meet the total phosphorus target for the Minnesota River. The model recreates current conditions and predicts the impact of various management actions in the Minnesota River Watershed to reduce the concentration of total phosphorus in the Minnesota River. The computer model includes reductions from many sources of total phosphorus including farm fields, city streets, WWTFs, and stream banks. See the Technical Response that follows this summary for more details. One example of a total phosphorus reduction activity would be changing some cropland to prairie. This would result in less total phosphorus from soil and fertilizer entering the Minnesota River.

Comment 2b: 80% exceeds flow is very rare.

Summary Response 2b: The computer model examines all summer flows over a 14-year period. MRVPUC’s TP limit is not based on the 80% exceeds flow. So this comment is not relevant to how the MRVPUC WWTF’s TP limit was calculated.

Although it was not used to explicitly derive the TP limit for the MRVPUC WWTF, the 80% exceeds flow was discussed to some extent in the Minnesota River Basin TP effluent limit memorandum (Basin Memo) to isolate the impact of the point sources when comparing the various model outputs. As a result a brief discussion of the 80% exceeds flows is included here. River flows are often considered over many years since flows are so variable year to year. The yearly variability depends on recent and long-term weather patterns. Flows over many summers are at or below the 80% exceeds flow 1 out of every 5 summer days. As the commenter points out in later comments, low flows, such as the 80% exceeds flow, are when algae grow the most. Again, algae need TP to grow to excessive levels even if everything else is right for them to flourish. Low flows are also the flows when point sources are a larger proportion of TP source to the river.

The MPCA issued the Winsted WWTF a TP limit based on a calculation where the river flow was set at the 80% exceeds flow. The process for setting limits for the Winsted WWTF has been upheld by the Minnesota Court of Appeals.

Comment 2c: Use of 70% of AWWDF for WLAs and WQBELs.

Summary Response 2c: The 70% of average wet weather design flow (AWWDF) was not directly used in the computer model. The computer model calculates a total mass of TP that can be discharged by the WWTFs in the Minnesota River Basin including the MRVPUC WWTF. MPCA designed a method to divide the mass equitably for the continuous-discharging WWTFs in the Minnesota River Basin. The 70% of AWWDF represents what a WWTF typically discharges during low flow at full design capacity. The total mass for all of the individual facilities must not exceed what was calculated the computer model. The mass for each facility was calculated with the following equation:

Mass = facility flow (70% AWWDF) x categorical concentration x conversion factor

Comment 3: MPCA did not recognize current conditions when setting limits.

Summary Response 3: The MPCA did recognize current conditions of the Minnesota River. Major reductions in WWTF total phosphorus loads in the Minnesota River occurred prior to 2011. Other sources of total phosphorus in the watershed have not reduced as quickly as the WWTFs. Since 2011, water quality in the Minnesota River has still been well above the total phosphorus and algal levels (Chlorophyll-a) necessary to support healthy aquatic life (fish and aquatic insects). The MPCA is required by law to set limits that will achieve water quality targets when there is a problem. The limits assigned to MVRPUC WWTF and the other WWTFs within the Minnesota River Basin assume that other sources of total phosphorus will be reduced and total phosphorus levels discharged by WWTFs will be slightly reduced. Some facilities, such as MRVPUC WWTF, will not need to reduce their current loads to meet the assigned limits.

Comment 4: Current data suggest the standard used is flawed since the Minnesota River doesn't achieve 35 µg/L chlorophyll-a at low flow when TP is near 150µg/L and TP has a poor correlation with chlorophyll-a in the Minnesota River.

Comment 4a: Point source discharges are not causing RES TP exceedance.

Summary Response 4a: Many sources of TP are causing the River Eutrophication Standards (RES) exceedance in the Minnesota River Basin. MPCA's approach to setting effluent limits ensures that WWTFs are only required to reduce their fair share of TP. The correct measure that is used to set limits for WWTFs is based on their "contribution of TP" to the RES exceedance based on federal law and court decisions. The TP concentration target for the Minnesota River is 0.150 mg/L (parts per million). The effluent concentration from WWTFs in the Minnesota River Basin generally ranges from 0.3- 4.0 mg/L.

Thus, the WWTFs are adding water with a TP concentration above the target TP concentration and contributing to the problem.

Comment 4b: Additional point source controls will not achieve RES at average flows.

Summary Response 4b: MPCA staff agree that non-point sources need to be considered, which is why the modeled results for all flow conditions were presented in the Basin Memo. It is likely that point and non-point reductions will be needed to achieve RES at average flows. The EPA would not allow the MPCA to wait to establish RES based effluent limits for WWTFs until all other sources of total phosphorus are reduced to match the reduction levels called for in the computer model, nor would it be consistent with both state and federal requirements.

Comment 4c: The conceptual framework upon which the RES relies is invalid for the Minnesota River.

Summary Response 4c: MPCA believes the conceptual framework behind the RES is valid for the Minnesota River. The Minnesota River produces high levels of algae when the average concentration of TP is 0.249 mg/L. Again, the RES target is 0.150 mg/L. The “conceptual framework” behind the RES would predict high chlorophyll-a levels currently observed in a large river such as the Minnesota River due to the current high average TP concentration. The MPCA is confident that algal levels will decrease to RES target levels when the average concentration of the Minnesota River reaches 0.150 mg/L.

Comment 5: BOD data indicate compliance with RES criterion.

Summary Response 5: BOD data alone are not sufficient to indicate compliance with RES. The Minnesota River is a murky greenish brown color from average to low flows. The fish and bugs are not doing well in the river. It is not prudent to assume that the Minnesota River meets RES on the basis of only one response variable when all other measures indicate an impairment.

Comment 6: Standard methods confirmed BOD is not a nutrient impairment indicator.

Summary Response 6: Algae can and do die in rivers. As the algae die and decompose, the process consumes dissolved oxygen. This can result in insufficient amounts of dissolved oxygen available for fish and other aquatic life. The process of decomposition is called Biochemical Oxygen Demand (BOD). Algal die offs can happen when a shallow river gets deeper and there is no longer sufficient sunlight for the algae to survive. This happens during low flows conditions in the dredged portion of the Minnesota River near the Twin Cities.

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Technical Response

The MRVPUC's comments assert that the Minnesota Pollution Control Agency (MPCA) used a mass balance approach at the 80% exceeds flow and did not consider non-point sources.

The mass balance approach is used to develop river eutrophication standards (RES) based effluent limits if water quality model data are not available. However, for this permit, water quality model data were available so a mass balance approach was not used.

Specifically, total phosphorus (TP) limits for the MRVPUC permit were based on results from a Hydrological Simulation Program–Fortran (HSPF) computer model (Tetra Tech, 2009) (referred to herein as the "Minnesota River HSPF model"). All river flows during the summer months for a 14-year period (1993-2006) were evaluated to estimate a long-term summer average TP concentration for various modeled reduction scenarios.

The modeled scenarios included both point source reductions and non-point source reductions. The non-point source reductions were based on assumptions that best management practices will be implemented. In the *Procedures for Implementing River Eutrophication Standards in NPDES Wastewater Permits* (MPCA, 2015) (referred to herein as "implementation procedures" document, it is clear that models are generally favored when available for establishing wasteload allocations. These wasteload allocations (WLAs) are then translated to effluent limits.

> *Water quality models, TMDLs, load duration curves and Water Restoration and Protection Strategy can also be used to establish WLAs. The complexity of these latter techniques is beyond the scope of this document but generally would be favored over the mass balanced equation as they consider more factors in developing the WLA. (Procedures for Implementing River Eutrophication Standards in NPDES Wastewater Permits, MPCA, 2015)*

There was one reach of the Minnesota River near the city of Morton where a mass balance approach was presented in Wasley (2016) to assess the impact of wastewater treatment facilities (WWTFs) in the Minnesota River–Yellow Medicine River Watershed. This reach is upstream of the MRVPUC WWTF outfall and is generally not directly applicable to the limits for the MRVPUC WWTF. This mass balance calculation for the Minnesota River near the city of Morton was developed because model results for that reach were not available when the Minnesota River Basin phosphorous effluent limits review and Minnesota River Basin phosphorus effluent limit memorandum (Wasley, 2016) (referred to herein as "Basin Memo") were completed. The mass balance approach for the Minnesota River at the city of Morton was used to verify that downstream limits based on model results were sufficient to meet local RES targets. The mass balance approach was also used for a sensitivity analysis to determine if concentration limits were needed for facilities in the Minnesota River–Yellow Medicine River Watershed. This sensitivity analysis was used as a surrogate for the downstream reaches on the Minnesota River including the reach to which MRVPUC discharges. Without this sensitivity analysis, MVRPUC would have been issued a calendar month average concentration limit applicable from June to September. Concentration-based limits are more restrictive than mass limits when facilities are well below design flows.

The Minnesota River HSPF model was the foundation for the Lower Minnesota River Dissolved Oxygen TMDL (Gunderson and Klang 2004), and it was used as a model input source for the draft Lake Pepin TMDL (LimnoTech 2009). The Minnesota River HSPF model allows for the incorporation of multiple point sources in one modeling effort. Given the complexity of the Minnesota River Basin and RES, the HSPF model was the best tool for establishing wasteload allocations in the Minnesota River Basin. The Basin Memo looks at the different wasteload allocations of all the TP related impairments downstream of the MRVPUC WWTF (i.e., Lower Minnesota River Dissolved Oxygen TMDL, draft Lake Pepin eutrophication TMDL, and RES in the Minnesota River). The Minnesota River HSPF model predicts TP levels for the Minnesota River near the city of Jordan which is downstream of MRVPUC's outfall. The Minnesota River HSPF model predictions are compared to applicable eutrophication standards to determine wasteload allocations for contributing WWTFs. The wasteload allocation is then converted to a water quality based effluent limit (WQBEL).

State rule allows for consideration of non-point reductions when setting effluent limits (*See* Minn. R. 7053.0205, Subp. 7. C). The use of models and non-point reduction assumptions were critical in the Metropolitan Council Environmental Services (MCES) Mississippi River Basin TP Permit. The Minnesota Court of Appeals recently affirmed MPCA's application of this rule when establishing effluent limits for the MCES Mississippi River Basin TP Permit. The process for establishing the MRVPUC TP limits was very similar to the process for establishing the MCES WWTF limits.

Comment 1: Limits set based on the implementation procedures document is violation of state law.

Response 1: The implementation procedures document provides examples to help clarify the process MPCA staff use to develop effluent limits in consideration of existing state law and federal regulations. No new rules or regulations are created in the document. Instead, the document is used to provide transparency of the methods used by MPCA.

It is not a statement of general applicability as the facts and circumstances of each specific case are taken into consideration (i.e., availability of data, an applicable water quality model, TMDL(s), load duration curves, and consideration of the unique aspects of the facility and discharge at issue). Here, the proposed TP effluent limits for the MRVPUC WWTF are based on HSPF model output, a process consistent with federal and state law, and appropriate for these facts and circumstances. The MPCA's development of RES effluent limits has been upheld by the Minnesota Court of Appeals.

Comment 2: The MPCA failed to implement the RES based on long-term summary average conditions.

Comment 2a: Limits are not based on a long-term summer average concentration.

Response 2a: The MPCA used an HSPF model to calculate the long-term summer average TP concentration of the Minnesota River at Jordan to determine the impact of point and non-point reductions over all flow conditions including average flows (Table 1 below). The MPCA used the HSPF model to run multiple scenarios for the Minnesota River. The model scenarios run by the MPCA provided sufficient information to make permitting decisions, thus additional scenarios were not needed. When predicted concentration values are presented across all flows in a concentration duration curve, sound conclusions can be reached as to the reductions needed to meet a long-term average of 0.150 mg/L TP which is the applicable RES criterion for TP (Figure 1 below).

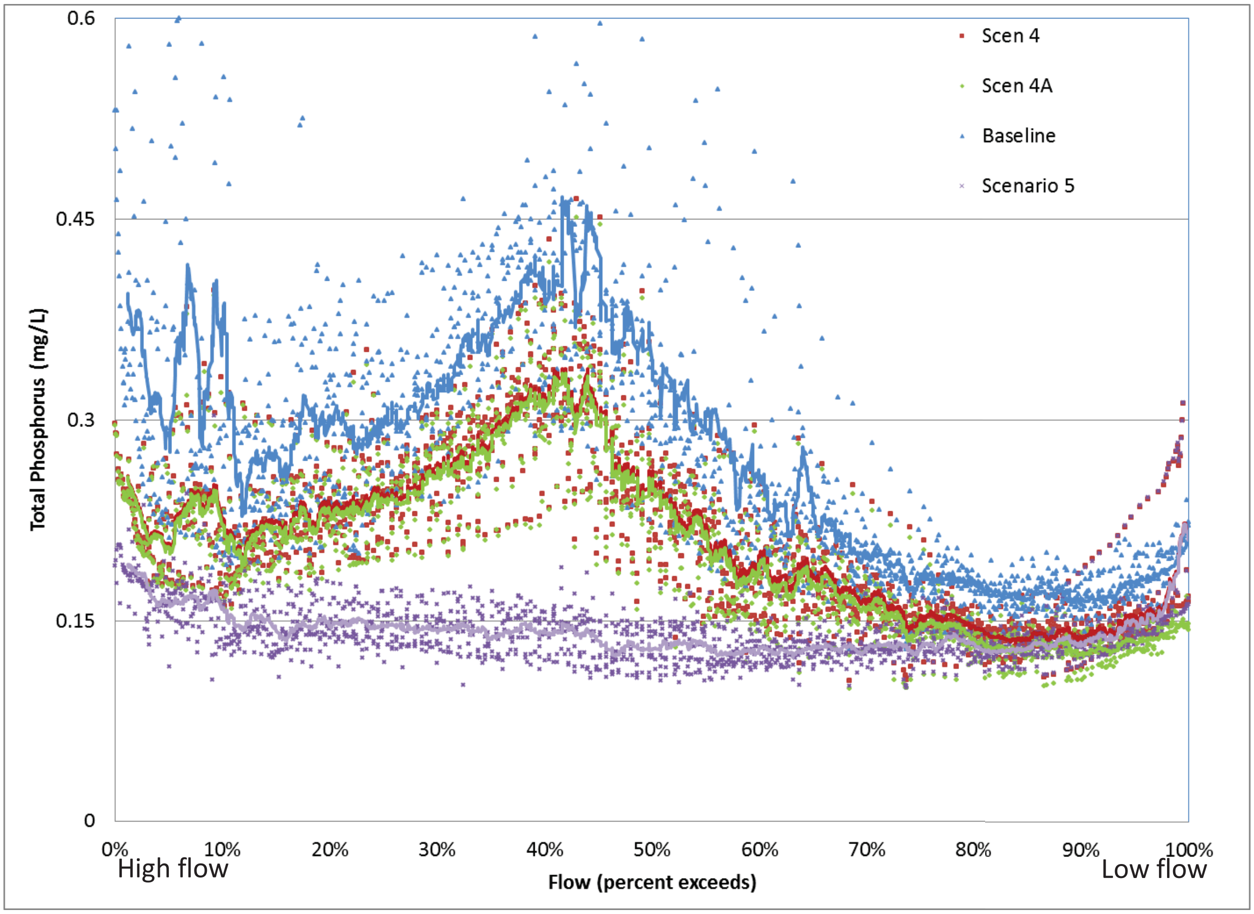
Comparing scenarios 4 and 4a from the Minnesota River HSPF model reveals that total elimination of point sources would have the most impact on TP concentration at low flows (80% to 100% exceeds). The impact of increased non-point reductions can be assessed by comparing high flows to the baseline scenario, scenario 4, and scenario 5 at average. Non-point reductions have the most impact from the 0% to 70% exceeds flows when the predicted concentration of TP exceeds the criterion 0.150 mg/L in scenario 4. Thus, MPCA concluded that non-point reductions between those modeled in scenarios 4 and 5 would be needed to reduce TP concentration at average to high flows to ultimately meet the TP criterion of 0.150 mg/L as a long-term average. It should be noted that Scenario 5 has a long-term average of 0.142 mg/L which meets the TP criterion of 0.150 mg/L. Effluent limits are being coordinated with TMDL development to determine the ultimate allocations for point sources, non-point sources, and other allocations such as margin of safety.

Table 1. HSPF modeled long-term summer average total phosphorus for the Minnesota River at Jordan. [Table 1 in Basin Memo (Wasley, 2015)]

Scenario	Average summer TP (mg/L)	Description
Baseline	**0.274**	Historical conditions from 1993-2006
4	**0.213**	Level 4 non-point reductions with continuous point sources at 1.0 mg/L and historic actual effluent flows
4a	**0.206**	Level 4 non-point reductions with continuous point sources at 0.0 mg/L and historic actual effluent flows
5	**0.142**	Level 5 non-point reductions with continuous point sources at 1.0 mg/L and historic actual effluent flows

Figure 1. Daily summer (June-Sept) total phosphorus predicted by HSPF for the Minnesota River at Jordan from 1993 – 2006. [This is Figure 1 in Basin Memo (Wasley, 2016)]

Note: TP data is arranged by flow (percent exceeds) for the Minnesota River based on the summer flow from 1993-2006. See Table 1 for description of scenarios. Lines represent moving average for scenarios (n=20.



Following are excerpts from the Minnesota River HSPF model which elaborate further on model scenario 4 (Tetra Tech 2009). Table 2 highlights the non-point reductions assumed in scenario 4 of the HSPF model.

Scenario 4

The results of Scenario 3 demonstrated that additional management measures would be needed to achieve water quality standards. After presentation of the Scenario 3 results, participants at the Minnesota River Turbidity TMDL Stakeholder Committee meeting of July 24, 2008, developed a list of additional ideas for the next model scenario. Four important areas for additional focus included an effort to reduce sediment loading from ravines and gullies, water storage and upland drainage management, land use changes including conversion of agriculture to perennial crops, and reductions in bank and bluff erosion. Together these ideas formed the basis for Scenario 4 – "accelerating change."

Potential ideas for reducing loading from ravines and gullies included energy dissipation, including installation of drop structures on tile drain outlets at the head of ravines, rerouting flow away from ravines, and physical rehabilitation.

Water storage and upland drainage management included a variety of ideas, many of which were aimed at retaining the first inch of water for 24 hours at or near the source, reducing erosive potential. This might be achieved through use of settling basins or constructed wetlands, culvert downsizing, modified ditch design, and changes to drainage management.

The land use changes considered included increases in Conservation Reserve Program conversions of crop to grassland, increasing crop residue cover, increasing use of reduced tillage or no-till practices, and conversion of some cropland to perennial crops.

Finally, results of the previous scenarios indicated that a significant portion of the observed excursions of sediment concentration targets was due to bank and channel erosion processes in the bluff areas. Therefore, some actions were also recommended to stabilize the stream banks and bluff areas, either through engineered solutions or through improved riparian plant cover.

Considerable effort was required to interpret these site-scale recommendations into components appropriate to the large-scale simulation model. The ways in which these ideas were incorporated into Scenario 4 are summarized in Table 2.

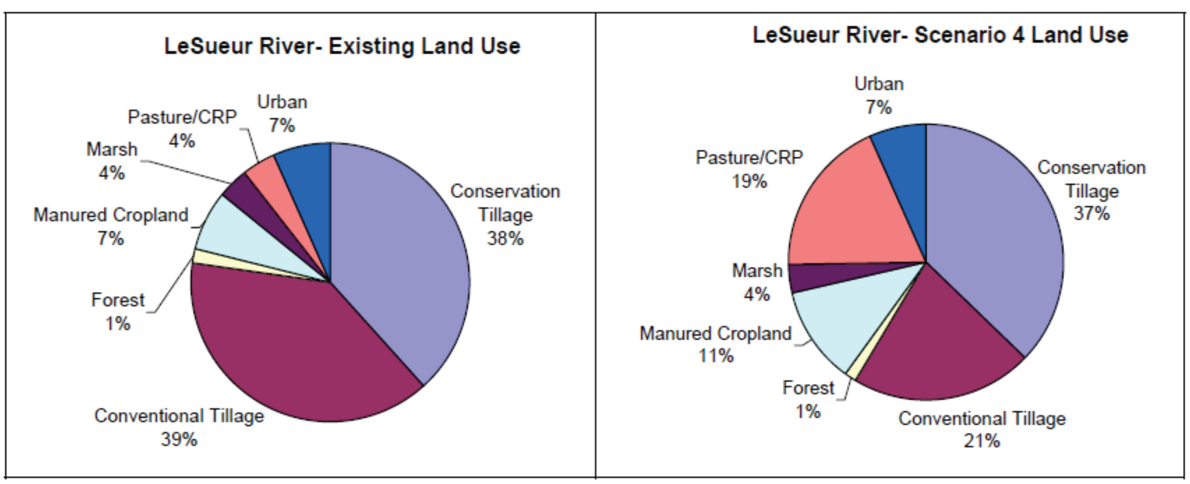
Table 2. Scenario 4 development (Table 2.5 from the Minnesota River Basin Turbidity TMDL Scenario Report)

Table 2-5. Scenario 4 Development

Scenario Component	Modeling Approach	Approach/Information Needs
Land Use: Increase pasture/CRP/ perennial crops plus forest to 20% of the watershed. Target areas near nickpoints, particularly in Blue Earth and Le Sueur. Achieve by reducing conventional tillage only. Increase Chippewa to 30%.	General changes in land use are addressed by repopulating the land use table in the Schematic block. Spreadsheet tools are already available to assist with this.	Setup same as Scenario 3 – except for Chippewa. New CRP is represented as perennial crops as in Scenario 3. Refocus assignment of new CRP to reaches near stream nickpoints by weighting toward the segments that contain the bluff areas
Cropping System 75 percent of row cropland with slopes greater than 3 percent use crop residue of 37.5 percent or greater. In addition, these lands have a cover crop to increase the spring cover. All surface tile inlets are eliminated. Nutrient management: follow U of M fertilizer recommendations. Manure management plans adjusted to nitrogen; full implementation of plans with setbacks from sensitive areas. 30% reduction in sediment from ravines due to use of drop structures, etc. 40% reduction in Blue Earth and Le Sueur	Increasing residue on higher slope lands is done by calculating the fraction in the higher slope category for each subbasin and adjusting the conservation tillage area accordingly. Tile inlet protection is simulated by reducing Special Actions factor controlling rate of sediment influx to tile drains. Results of changes in fertilizer and manure application rates were simulated previously. Parameters controlling nutrient load are adjusted in accordance with changes in application rates. Ravine loading is simulated as a function of flow depth, applied to cropland only.	Fraction in conservation tillage is same as in Scenario 3: Existing high residue fraction kept for slopes less than 3%; those greater than 3% brought up to 75% of land at 37.5%. Cover coefficients for cover crop based on analysis of RUSLE scenarios for Beaver Creek. Change residue percentage to 37.5%; because a winter cover crop is already included, this increases cover only for June. Reduce sediment inflow to tile drains to nominal amount by changing SPECIAL ACTIONS factor from current value (varies by watershed, typically around 0.4) to 0.05. Decrease INTFW (rolled into Upland Drainage section) Same as Scenarios 2-3. Results in increase in manured land area. Reduce the multiplicative factor on ravine transport (KGER). Confirmed that this is accomplished by proportional reduction in KGER.
Upland Drainage Management Controlled drainage on crop land with < 1% slope (5/15-9/15) Two-stage ditch design Store 1" runoff for at least 24 hours.	These factors are strongly inter-related. The third item may be largely achieved by implementing the first two. HSPF does not simulate local ditches directly, so address by increasing land surface storage capacity, which is a function of the product of surface roughness and slope length (NSURxLSUR). Controlled drainage is represented by decreasing interflow inflow (INTFW).	Increase NSURxLSUR: Due to limitations in allowed values in HSPF for NSUR, achieve this by increasing LSUR from 450 to 2350 (4750 in Blue Earth and Cottonwood) for LU 2,3,7 to achieve appropriate surface storage values of 1" max surface storage with INTFW reduced to 1.5. This increase is based on sensitivity analysis. Prorate summer INTFW to achieve 1.5 on lands <1% slope. For same lands, increase IRC to 0.95. Set SDOP to 0 so that transport capacity is not a function of stored water depth. Two-stage ditches are not explicitly modeled, but are assumed to be a part of the increased water storage capacity.

Scenario Component	Modeling Approach	Approach/Information Needs
Bank and Bluff Erosion Decrease maximum scour to simulate bank stabilization	HSPF asymptotes to maximum scour rate (M) as flows rise above critical shear. Change M.	No changes to bluff collapse rates. Reduce M silt and M clay by 20% for each reach; also KSAND. No changes made to critical scour values.
Wastewater Discharges 1 mg/l TP for all mechanical facilities.	P limit is readily simulated by changing the ext sources linkage to represent P as a fixed concentration multiplier on effluent flow.	Revert from Scenario 3 to Scenario 2 conditions. Includes industrials and stabilization ponds classed as majors and individually simulated. A separate run (Scenario 4A) is made with point source P loading turned off.
Urban Stormwater Infiltrate the first inch of runoff from both impervious and pervious urban surfaces.	Generalized "treatment" of urban runoff is done by routing flow from urban impervious surfaces to a special unit-area RCHRES that routes water and treats the first inch.	Apply to pervious and urban impervious area within the MS4 boundaries. No change from Scenario 3. No reductions to developed lands outside MS4 boundaries
Baseflow Sediment Concentration Remove "extra" sources.	Calibration for several basins requires adding a low-flow clay load associated with ground water (may represent instream activities such as gravel mining as well). These are considered manageable loads that can be reduced or removed.	Reduce those basins with higher values – e.g., any with concentration greater than 5 mg/L reduced to 5.

The various components of Scenario 4, taken together, would result in significant changes in the distribution of land uses in the Minnesota River watershed. These changes are summarized graphically in Figure 2-1 over the next several pages.



Comment 2b: 80% exceeds flow is very rare.

Response 2b: The 80% exceeds flow was discussed to some extent in the Basin Memo to isolate the impact of the point sources when comparing the various model outputs. As stated in the preceding response, the limits for the MRVPUC WWTF were based on achieving the TP criterion as a long-term summer average, rather than a moderate low flow (80% exceeds). The 80% exceeds flow has the same relevance to the MRVPUC WWTF as all other flows. The following discussion is included to clarify the selection of the 80% exceeds flow for the mass balance approach to establishing effluent limits. Again, the MRVPUC limit is based on a model that considers all summer flows.

The commenter contends that the 80% exceeds flow has return frequency of 1 in 14 years. MPCA agrees that an entire summer with average flows at or below the 80% exceeds is rare. However, the commenter's analysis would suggest that river flows remain fixed or static during summer periods, when in fact, river flow is dynamic within any given summer. The 80% exceeds flows, as discussed in the implementation procedures, is based on all summer flows for a 30-year period. Flows over this 30-year period are at or below the 80% exceeds flow 1 in 5 days. As the commenter points out in later comments, low flows are when algae grow the most. This is also the flow when point sources are a larger proportion of TP sources to the river.

MPCA staff's analysis of the flow data for the Minnesota River near Jordan provides a different interpretation of the return frequency of the 80% exceeds flow. The MPCA staff found that 17 out of 30 years had flows at or below 80% exceeds for at least one day (Table 3 below). More importantly, the MPCA found that 12 of 30 years had more than 30 days at or below 80% exceeds flow, conditions that are very favorable for excess algal growth in the Minnesota River. The commenter pointed out that EPA recommends a once in three year exceedance frequency for protecting aquatic life. The 80% exceeds flow is very similar to a 30_Q3 flow and EPA's recommendation was part of the basis for selecting the 80% exceeds flow.

Table 3. Number of days at or below 80% exceeds flow for the Minnesota River at Jordan from 1986-2015.

Year	Days at or below 80% exceeds	Percent of summer days at or below 80% exceeds flow
1986	0	0%
1987	40	33%
1988	117	96%
1989	117	96%
1990	13	11%
1991	0	0%
1992	0	0%
1993	0	0%
1994	0	0%
1995	0	0%

1996	10	8%
1997	0	0%
1998	17	14%
1999	4	3%
2000	39	32%
2001	39	32%
2002	12	10%
2003	44	36%
2004	0	0%
2005	0	0%
2006	46	38%
2007	31	25%
2008	43	35%
2009	63	52%
2010	0	0%
2011	0	0%
2012	65	53%
2013	35	29%
2014	0	0%
2015	0	0%
1986-2015	**735**	20%

Comment 2c: Use of 70% of AWWDF for WLAs and WQBELs.

Response 2c: Federal regulations require that MPCA examine the reasonable potential for permitted discharges to cause or contribute to a state water quality standard (40 CFR 122.44 (d)). MPCA uses 70% of Average Wet Weather Design Flow (AWWDF) in the effluent limits analysis for RES because it is a reasonable representation of the full build-out capacity, or potential, of a WWTP. Design flow numbers more directly reflect the capacity to serve a set number of users, often determined through community growth and planning estimates. By targeting the full build-out capacity, estimated at 70% of AWWDF during dry weather conditions, we can ensure that the recommended limits will remain protective into the future as the facility approaches its design capacity. This is part of the "reasonable potential" analysis. If we simply estimate the facility's impact based on current actual flow, the effluent limit will not be consistent with achieving the in-stream goal as the facility reaches its full design capacity. This is especially important when we consider multiple discharges to a single river reach of concern.

The model inputs for the MRVPUC WWTF and all other WWTFs in the Minnesota River Basin were actual historical flows and 1.0 mg/L of TP for Minnesota River HSPF model scenarios 4 and 5. The MPCA calculated the TP mass discharged by continuously discharging WWTFs in the Minnesota River Basin for scenarios 4 and 5 (see Table 2 in Basin Memo). The actual average flow from the continuous facilities in the Minnesota Basin HSPF model from 2000-2006 is 34.9 mgd. The 36.6 mgd value reported in Table 2 of the Basin Memo represents the average flow from 2001 to 2014. This mass based on historical flows and 1.0 mg/L of TP was divided among the continuous facilities based on categorical concentration multipliers and 70% of AWWDF (See Table 3 in Basin Memo). Since the RES based limits are mass limits only, facilities that discharge below 70% of AWWDF can discharge above the assumed categorical concentration multiplier and still meet the mass limit.

Mass is the ultimate target of the WQBEL and 70% of AWWDF was used to estimate concentration performance needed from the MRVUC facility as it approaches its full design capacity.

Comment 3: MPCA did not recognize current conditions when setting limits.

Response 3: The MPCA sent the city of Mankato a response to its comments regarding TP limits for the Minnesota River in January 2016. This document was included in the set of documents sent in by MRVPUC. This included more recent data for the Minnesota River. The MRVPUC is focused on the low flow conditions of the recent years. It appears that the Minnesota River is progressing toward the modeled concentrations at low flows presented in the preceding response to comment #2. Based on the updated monitoring, there is no evidence to suggest that the Chl-a or TP criteria are met as a multi-year average during recent years (2011-2015) downstream of MRVPUC WWTF in the Minnesota River at Jordan (Table 4).

Table 4. Simple summer averages of the Minnesota River at Jordan from 2011 to 2015.

Year	Chlorophyll-a (µg/L)	Total phosphorus (mg/L)
2011	38.2	0.221
2012	82.5	0.212
2013	65.9	0.233
2014	61.4	0.293
2015	53.3	0.289
2011-15 average	**60.2**	**0.249**
RES Criteria	**40.0***	**0.150**

*Chlorophyll-a criterion will be 35 µg/L when the state rule is revised.

Certainly, non-point reductions have not progressed at the same rate as point source reductions in the Minnesota River Basin, but that does not allow MPCA to avoid establishing WQBELs for the WWTFs in the Minnesota River Basin. Figure 6 in the commenter's letter demonstrates that water quality, in spite of historic point source load reductions, still exceeds standards under most flow conditions. Figure 5 in the commenter's letter shows historical reductions in point source loading to the Minnesota River Basin. Significant pollutant reductions have been achieved since the early 2000s. However, when setting limits, MPCA staff must not only examine what facilities are actually discharging, but also what they might potentially discharge at their full permitted load. Therefore, more restrictive limits are necessary to ensure protection of downstream waters now and in the future.

MPCA has found through the modeling effort, the concentration of TP in the river must be below 0.150 mg/L at low flows to meet the long-term average target (Figure 1). The comments from MRVPUC assert that meeting 0.150 at low flow on average is sufficient for setting effluent limits, but then they go on to state that high Chl-a is problematic when the TP concentration is 0.150 mg/L at low flow. The Minnesota River HSPF modeled scenario 5 indicates that the concentration of TP in the Minnesota River at Jordan will be at or below 0.150 mg/L from the 35 to 95% exceeds flow. Recent data indicate that these levels have not been achieved consistently in the Minnesota River at Jordan. Model input loads for scenario 4 and 5 are lower than current discharged loads from the facilities in the Minnesota River Basin. Once all of the WQBELs recommended in the Basin Memo are fully adopted, the MPCA is confident that concentrations in the Minnesota River will approach predicted concentrations in the HSPF model during low flows.

Current performance from some of the facilities, such as MRVPUC, are better than required by current effluent limits. However, facilities are not bound to current performance by existing limits in permits. Without the proposed limits, the MRVPUC WWTF could increase its loading to levels which could increase the concentration of the Minnesota River during low flows. Therefore, the potential load a facility could discharge in the future must be considered when developing effluent limits.

Comment 4: Current data suggest the standard used is flawed since the Minnesota River doesn't achieve 35 µg/L chlorophyll-a at low flow when TP is near 150µg/L and TP has a poor correlation with chlorophyll-a in the Minnesota River.

Comment 4a: Point source discharges are not causing RES TP exceedance.

Response 4a: The federal law requires that NPDES permits contain WQBELs for pollutants that have the reasonable potential to cause or contribute an exceedance of water quality standards [40 CFR 122.44(d)(1)(i)]. The MRVPUC WWTF is upstream of the Minnesota River near the city of Jordan which exceeds river eutrophication standards, and MRVPUC does discharge above the TP criterion of 0.150 mg/L. The comment asserts that the WWTFs current actual loads do not cause the impairment. The MPCA must consider permitted loads rather than actual limits when setting effluent limits. Based on the numbers provided in the comments, WWTFs' discharges represent 39% of the overall loads during the 80% exceeds flow. It is clear that the MRVPUC discharge has a reasonable potential to cause or contribute to the impairment during low flow conditions. Another line of evidence to assess "contribute to impairment" is to compare effluent concentration to the applicable total phosphorus criterion of 150 µg/L. Most of the WWTFs, including MRVPUC, are discharging above 0.150 mg/L TP and the Minnesota River is above 0.150 mg/L as a long-term average. Both point and non-point reductions from current levels are needed to hit 0.150 mg/L as a long-term average. The WWTFs certainly contribute to eutrophication impairment at average flows when TP and Chl-a are both above RES criteria.

The modeled solution has the WWTFs discharging at 1.0 mg/L and historic WWTF flows. Comparing Minnesota River HSPF model scenarios 4 and 4a allows for comparison of the impact of facilities at current flows and 1.0 mg/L TP (scenario 4) and the facilities set a 0.00 mg/L (Scenario 4a) (Figure 1 above). At the highest flows, there is little difference in removing the point sources based on comparing scenarios 4 and 4a. As flows decrease, scenarios 4 and 4a begin to separate indicating that the WWTFs do contribute during lower flows.

The comments provided demonstrate the importance of TP from WWTFs when the response portion of RES (i.e., chlorophyll-a) is exceeded. MPCA staff agree that current and proposed WWTF loads are relatively small compared to non-point loads during average to high flows. MPCA staff also agree that the Chl-a is lower during high flows. There is a claim that the standard used is flawed at low flows when Chl-a is high and the point sources are a larger proportion of the overall TP load than during high flows. Comparing Minnesota River HSPF model scenarios 4 and 5 indicates that additional non-point best management practices have much more impact at high flows than during low flows (Figure 1 above). WWTFs are the most reducible source at low flows when conditions for algal growth are ideal.

Comment 4b: Additional point source controls will not achieve RES at average flows.

Response 4b: MPCA staff agree that non-point sources need to be considered, which is why the modeled results for all flow conditions were presented in the Basin Memo. It is likely that point and non-point reductions will be needed to achieve RES at average flows. The proposed solution for the Minnesota River at Jordan is close to Minnesota River HSPF model scenario 5. The continuous WWTFs were set at historic flows and 1.0 mg/L in scenario 5. Achieving point source controls throughout the Minnesota River Basin will reduce TP concentration during low flows when algal levels are generally highest. Non-point reductions have less impact at low flows.

Comment 4c: The conceptual framework upon which the RES relies is invalid for the Minnesota River.

Response 4c: The river eutrophication criteria are a long-term average of 0.150 mg/L TP and 35 µg/L Chl-a. The MPCA agrees it is possible to grow more than 35 µg/L chlorophyll-a when TP is 0.150 mg/L if other factors that impact algal growth are ideal. Low flow conditions are ideal conditions for growing algae when turbidity is lower and residence times are higher. An average allows for some values to exceed the standard as long as other values are below the average. Rivers are dynamic systems where flow, Chl-a and TP change constantly. Algal levels in rivers are controlled by flow, TP, and other factors. Minnesota's RES are based on averages which basically summarize the variable conditions of one river into a single value.

The RES is not flawed for the Minnesota River. Recent averages (2011-2015) for the Minnesota River at Jordan are 0.249 mg/L TP and 60.2 µg/L Chl-a (See response to comment 3 for additional information). The TP is still 0.99 mg/L over the TP criterion on average. Substantial TP reductions are needed over all flows to match the HSPF modeled solutions in Figure 1, above, which achieves 0.150 mg/L as a long-term summer average. The model predicts that concentration will be below 0.150 mg/L TP during low flows to achieve long-term average of 0.150 mg/L. Lower TP at low flows will likely reduce Chl-a at low flows. The comment makes no prediction of what Chl-a would average if the long-term average TP was

0.150 mg/L, it merely isolates ideal algal growth conditions and states that 0.150 mg/L TP does not equal 35 µg/L Chl-a under optimal algal growing conditions.

Even with dramatic non-point best management practices is it unlikely to achieve 0.150 µg/L TP during average to high flows in the Minnesota River (Figure 1 above). High flows limit Chl-a already and this is not expected to change. So higher concentrations of TP at high flow are not as important as TP concentrations at lower flows for local rivers. High loads of TP during high flows are important to downstream resources such as Lake Pepin and the Gulf of Mexico. The Nutrient Reduction Strategy and eutrophication TMDLs for the Minnesota River and Lake Pepin will address non-point sources of TP. The TP concentrations during average to low flows, when algae grow the most, must be below 0.150 TP µg/L to average down higher flow TP concentrations. Note, the high flow TP conditions were dramatically reduced from baseline levels in HSPF scenarios 4 and 5 (Figure 1 above).

Comment 5: BOD data indicate compliance with RES criterion.

Response 5: The RES require that the cause variable (TP) and one response variable exceed applicable criteria. Both TP and Chl-a clearly exceed the criterion in the Minnesota River at Jordan. Chl-a is the strongest link to high algae levels.

Comment 6: Standard methods confirmed BOD is not a nutrient impairment indicator.

Response 6: The MPCA has already defended legal challenges to the inclusion of BOD and DO flux as response variables in the RES in Minnesota State Rule 7050. As stated in the response to comment 5, the concentration of BOD alone is irrelevant given TP and Chl-a exceed criteria in the Minnesota River at Jordan.

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